

**E75-10127**  
**CR-141980**

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Water Survey of Canada: Application for Use  
of ERTS-A for Retransmission of Water  
Resources Data

(E75-10127) WATER SURVEY OF CANADA: APPLICATION FOR USE OF ERTS-A FOR RETRANSMISSION OF WATER RESOURCES DATA Semiannual Progress Report, Jul. - Dec. 1974 (Department of the Environment, Ottawa)	N75-16048  Unclas 9 p G3/43 00127
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January 1975

Type II Report for the Period July - December 1974

1. SR No. 9629	2. Type of Report Type II	3. Recipient's Catalog No.
4. Title Water Survey of Canada; Application for Use of ERTS-A for Retransmission of Water Resources Data	5. Report Date January, 1975	6. Period Covered July - December 1974
	8. No. of Pages 7	
7. Principal Investigator R.A. Halliday	9. Name and Address of Principal Investigators Organization  Applied Hydrology Division, Department of the Environment, Ottawa, Ontario, Canada. K1A 0E7	10. Principal Investiga.Rept.No.  11. GSFC Technical Monitor George Ensor
12. Sponsoring Agency Name and Address  Department of the Environment, Ottawa, Ontario, Canada. K1A 0E7	13. Key Words(Selected by Principal Investigator) Data Retransmission, Data Collection Platforms, ERTS, DCP Failures.	
14. Supplementary Notes  Report prepared by I.A. Reid and R.A. Halliday.		
15. Abstract  Water resources data including water level, water velocity, precipitation, air temperature, "ice-out" indicator, DCP battery check and water stage recorder clock operation have been transmitted from remote areas in Canada using the ERTS Data Collection System. The System has met requirements.  Two DCP failures occurred during the reporting period. The platforms were repaired in Ottawa without difficulty and are back in service.  The suitability of satellite retransmission has been demonstrated. The present network will be expanded to 28 in 1975.		

## PREFACE

The purpose of the investigation is to use ERTS Data Collection Platforms (DCPs) to transmit water level and other related readings from each of the nine remotely located platforms and to use the information for operational purposes.

The DCPs have been used to transmit water level data from sites in northern and western regions of Canada. Other data transmitted from some locations include precipitation, air temperature, water velocity, "ice-out" indication, DCP battery voltage, and water stage recorder operation check. Data were used both for water management purposes and for planning hydrometric field activities.

During the six months July to December 1974, about 10,000 transmissions were received.

DCPs 6232 and 6137 failed during the period and were repaired. DCP 6260 which failed during the last reporting period has not been re-installed on the Mackenzie River since its repair as it was received too near the end of the shipping season. DCP 6366 has been turned off for the winter and DCP 6126 is in storage pending re-location at another site.

On the basis of experience to date, it is apparent that water resources data can be transmitted reliably at reasonable cost by satellite.

Type II Progress Report for the Period  
July to December 1974

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The Water Survey of Canada operates over 2400 gauging stations at which water level data are collected. These data are used for river flow and flood forecasting, water level forecasting and for navigation. At many stations, it would be desirable to obtain data on a near real time basis, however, because of the isolated locations of most gauging stations, the cost of doing this has been prohibitive.

Therefore, when the ERTS Data Collection System was proposed, it seemed worthwhile to investigate the possibility of using a satellite retransmission system to collect discrete water level readings at least once daily from a few gauging stations and to use this data for operational purposes. In this way, a valid assessment regarding reliability, costs and other aspects of the whole system could be studied and decisions made with respect to the feasibility and advantages of establishing a much larger network of DCPs dependent on future satellite facilities. The sites were selected to give a wide range in climatic and areal conditions.

Nine sites were selected for an experiment with data relay by ERTS spacecraft. Since the original selection was made, several of the DCPs have been relocated to more strategic locations for forecasting of water levels and river flows. Table One lists the present location of the DCPs.

In cooperation with the Atmospheric Environment Service (AES), Department of the Environment, a Hydrometeorological Recording and Telemetry System (HARTS) was installed having precipitation and air temperature inputs along with a Marsh-McBirney electromagnetic water current meter at the Nahatlatch River site (DCP 6232) on August 29, 1974.

Following the installation of the new sensors, the DCP did not transmit and, at first, it was thought that the failure had something to do with the HARTS system. This proved incorrect as subsequent inspection of DCP 6232 in Ottawa revealed failure in the DCP.

It was found that the trouble was in the Programmer Assembly (A3) Board. Corrosion, probably caused by condensation, was apparent at connectors A3J1, A3J2 and A3J3 and at I.C.s U25-27, U29-30, U34 and U36-39. Problems with the above were corrected and the board was spray coated with GC Electronics Acrylic Plastic, GC #8665.

Table One

Location of Data Collection Platforms

<u>I.D.</u>	<u>Station Name</u>	<u>Lat.</u>	<u>Long.</u>
6126	In storage pending re-location.		
6232	Nahatlatch River Below Tachewana Creek	49° 57'	121° 52'
6354	McGregor River at Lower Canyon	54° 14'	121° 40'
6260	Mackenzie River near Wrigley	63° 16'	123° 36'
6366	Mackenzie River at Sans Sault Rapids	65° 46'	128° 45'
6150	Lake Athabasca at Crackingstone Point	59° 23'	108° 53'
6353	Kazan River at Outlet of Ennadai Lake	61° 15'	100° 58'
6102	Albany River above Nottick Island	51° 38'	86° 24'
6137	Winisk River at Kanuchuan Rapids	52° 58'	87° 42'

The DCP (6232) was successfully tested in Ottawa on October 24, 1974, and re-installed on the Nahatlatch River on November 13, 1974. The DCP along with the HARTS system worked perfectly. The water velocity meter did not transmit satisfactorily after a few weeks and has been removed for inspection and repair.

On September 27, 1974, Platform 6137 was removed from Ashweig River site and installed on the Winisk River at Kanuchuan Rapids using Cipel air depolarized carbon-zinc batteries as the source of power. A recorder clock operation check and a battery voltage check were installed also. This platform failed to transmit when relocated.

On October 10, 1974 during a regular field trip, the DCP was removed and sent to Ottawa for inspection and repair. In Ottawa, the cause of failure was determined to be short circuiting between the DCP transmitter assembly board and the heat sink plate caused by deterioration (flaking) of the metallic coating over a large area of the heat sink. Subsequent analysis of samples of this material by Bristol Aerospace Limited in Winnipeg indicated the coating was largely zinc in composition. The heat sink was anodized

and the platform installed on December 15, 1974. The platform transmitted water level readings, battery voltage and recorder clock operation check perfectly although with fewer messages per day. It is thought that the efficiency of the air depolarized carbon-zinc batteries drops off in extremely cold weather.

The number of transmissions from this site will be correlated with temperatures transmitted by DCP 6102.

On November 20, 1974, DCP 6126 was moved from the Duncan River below B.B. Creek as land line telemetry was extended to this site by the British Columbia Hydro Electric Power Authority. This platform is in storage pending installation at a remote site in British Columbia.

Table Two gives a summary for the retransmittal of data for the period July to December 1974 (cycles 41-50).

ERTS Data Collection System data have been used in many ways, some of which are illustrated in Figure One which is a copy of the 1973 streamflow data for the Nahatlatch River.

NAHATLATCH RIVER BELOW TACHEMANA CREEK - STATION NO. 08MF065													
DAILY DISCHARGE IN CUBIC FEET PER SECOND FOR 1973													
DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	---	---	---	---	783	2480	2400	2400	498	437 A	981	421	1
2	---	---	---	---	975	1900	2320	2370	463	391 A	810	403	2
3	---	---	---	---	1140	1710	2400	2300	470	365 A	686	398	3
4	---	---	---	---	1270	1950	3430	2260	475	348 A	606	388	4
5	---	---	---	---	1480	3030	3630	2050	597	345 A	540	379	5
6	---	---	---	---	1600	4530	2560	1730	790	335 A	493	388	6
7	---	---	---	---	1360	4750	2120	1510	765	330 A	495	475	7
8	---	---	---	---	1140	3800	1970	1560	640	320 A	480	488	8
9	---	---	---	---	975	2650	1930	1660	657	313 A	455	443	9
10	---	---	---	---	850	1950	2370	1740	847	311 A	501	429	10
11	---	---	---	---	765	1730	2190	1600	870	309 A	632	483	11
12	---	---	---	---	876	2540	2230	1470	882	330 A	737	516	12
13	---	---	---	---	1600	3740	2820	1450	690	465 A	636	506	13
14	---	---	---	---	3350	2610	3450	1490	544	383 A	574	487	14
15	---	---	---	---	4900	2050	3670	1300	470	345 A	534	500	15
16	---	---	---	---	5180	1740	3780	1270	427	448 A	506	729	16
17	---	---	---	---	5350	1620	3500	1290	406	383 A	470	709	17
18	---	---	---	---	5730	1450	3050	974	416	1850 A	443	599	18
19	---	---	---	---	4090	1570	3140	731	471	1880 A	419	541	19
20	---	---	---	---	884	2790	3120	616	572	2150 A	424	525	20
21	---	---	---	---	506	2100	3440	2690	634	1540 A	423	566	21
22	---	---	---	---	554	2140	5570	2150	639	1350 A	407	531	22
23	---	---	---	---	566	2690	6030	1590	512	942	395	502	23
24	---	---	---	---	545	6790	3770	1350	523	884	385	486	24
25	---	---	---	---	541	4040	3740	1380	461	803	385	467	25
26	---	---	---	---	618	2670	3390	1670	576	659	372	443	26
27	---	---	---	---	730	2120	3660	2320	572	724	372	431	27
28	---	---	---	---	658	2000	3950	2550	543	7440	513	416	28
29	---	---	---	---	623	2540	3530	2340	517	2700	504	402	29
30	---	---	---	---	659	3580	2760	2020	513	1630	442	353	30
31	---	---	---	---	3590	3590	2290	550	497 A	1220		330	31
TOTAL	---	---	---	---	80464	89700	78430	37859	17125	31930	15620	14734	TOTAL
MEAN	---	---	---	---	2690	2990	2530	1220	571	1030	521	475	MEAN
AC-FT	---	---	---	---	160000	178000	156000	75100	34000	63300	31000	29200	AC-FT
MAX	---	---	---	---	6790	6030	1780	2400	882	7440	981	729	MAX
MIN	---	---	---	---	765	1450	1350	512	406	309	372	330	MIN

SUMMARY FOR THE YEAR 1973

MAXIMUM DAILY DISCHARGE, 7440 CFS ON OCT 28

MAXIMUM INSTANTANEOUS DISCHARGE  
10900 CFS AT 1045 PST ON OCT 28

TYPE OF GAUGE - RECORDING  
LOCATION - LAT 49 57 15 N  
LONG 121 51 40 W

A-MANUAL GAUGE

NATURAL FLOW

TABLE TWO

SUMMARY OF RETRANSMITTED DATA FOR REPORT PERIOD

Platform ID	Daily Mean Transmissions per Cycle for Cycles 41 to 50									Transmissions Daily		Total
	41	42	43	44	45	46	47	48	49	Max.	Min.	
6126	7	7	7	6	7	6	7	-	-	10	2	846
6232	6	7	5	-		-	8	7	6	13	2	702
6354	7	8	7	6	7	7	7	8	7	10	2	1152
6260	-	-	-	-	-	-	-	-	-	-	-	-
6366	7	7	7	6	7	6	-	-	-	10	2	720
6150	14	14	14	13	13	14	14	14	13	17	4	2214
6353	15	15	14	13	15	14	14	15	13	19	4	2304
6102	14	15	14	13	15	14	14	15	13	18	2	2286
6137	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL:												10,224

The gauging station was established on April 20, 1973 and an ERTS DCP installed at about the same time. The water level data retransmitted by ERTS were used during the spring freshet for planning of hydrometric trips to the area to ensure that discharge measurements were obtained at the appropriate water levels. The data were also used during this time as an index of inflow into the Fraser River for Flood forecasting purposes.

Later in the year, on September 26, the clock on the water stage recorder stopped because of an error in servicing. Since the recorder was equipped with a clock operation sensor, the information on the clock stoppage was transmitted via ERTS-1 but, as this was not a critical period, a decision was made not to restart the recorder until the next scheduled visit. This was done on October 22. The 27 days of record that would have been missing under normal circumstances was filled in by plotting a hydrograph of the data transmitted by ERTS.

It is always difficult to attach a certain dollar value to the streamflow record obtained at a gauging station, however, it is apparent that use of an ERTS DCP did enhance the value of the record obtained at this particular site in 1973. The use of the platform also made it easier to plan hydrometric work at this site as it provided a foreknowledge of the conditions at the time of a visit.

The ERTS Data Collection System has continued to provide useful near real time data for water management purposes in Canada during this reporting period. Plans for the near future include expansion of the DCP network by installation of 19 Ball Brothers Research CDCP-100 platforms.